

Converting Measurements of Length

Reasoning and Problem-Solving Unit Plan

Schmitz Park Elementary School

4th Grade

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**1. CONTENT**

* 1. **Central Focus**

This unit is focused on converting units of measuring length in both the metric systems and the U.S. customary system. We will also be learning about the relative sizes of these units of measurement so that students are prepared to select an appropriate unit for measuring a given length. This unit on length fits within a larger unit on converting units of measurement for length, volume, mass, and time. This unit plan is written to cover the first four days of the larger unit, and to lay a solid foundation of conceptual understanding and procedural fluency in converting units of measurement that can then be transferred to other types of measurement.

* 1. **Rationale**

Length is everywhere in a student’s life from the distance they must walk between their house and school to the length of an eraser they have left on their pencil. Students must be equipped to fluidly convert units of length in order to accurately compare measurements of two objects or distances. They also must have a solid conceptual understanding of the relative sizes of different units of length so that they can select the appropriate unit to represent an object’s length. In their studies in later grades they must convert units of length in order to determine rates of speed, and be able to convert between measurement systems, so it is important to have a solid foundational understanding of the principle of unit conversion and of the two measurement systems before advancing to these other mathematical processes. Ethically, as teachers in the United States, we must prepare our students to be global citizens by teaching both the metric system and the customary system so that they are proficient in both systems, and therefore able to communicate and operate in an international environment. Furthermore, as a teacher I must meet the needs of all of my students by continually monitoring their individual progress, assessing their understanding, modifying my lessons to align with their interests, and differentiating instruction to meet their learning needs so I have created a unit plan that incorporates all of these elements of successful pedagogy.

* 1. **What students will know and what they will do with this knowledge**

Students will be able to fluently convert units of length within the metric system and within the customary system by expressing numbers in one unit in terms of another unit within the same system. Students will also be able to select the appropriate unit of measurement for a given object or distance and provide rationale for their selection. By developing this conceptual understanding and procedural fluency with converting measurements, students will also gain an appreciation for the accuracy that we can obtain by purposefully using the wide variety of units we have for measuring length.

* 1. **Learning Targets**

|  |  |  |
| --- | --- | --- |
| **Learning Target** | **Type of Learning Target** | **Common Core State Standard** |
| Students will understand the relative sizes of units of measurement. | Concept | 4.MD.A.1 |
| Students will convert units of length within the metric system and within the customary system. | Skill | 4.MD.A.1 |
| Students will appreciate how using a variety of units gives us the ability to accurately measure objects and distances around us. | Disposition | MP.4 & MP.6 |

* 1. **LTs connections with conceptual understanding, procedural fluency and reasoning**

The first learning target requires the development of a conceptual understanding of units of measurement and of how they are related to each other in size, as depicted by a given conversion factor. This also enables students to build a conceptual understanding of when to use a given unit (e.g. miles to measure the length between Schmitz Park Elementary School and the Space Needle, yards to measure the distance between our portable classroom and the school building, and inches to measure the distance between desks). The second learning target requires that students use this conceptual understanding from the first learning target to develop procedural fluency using the conversion factors to convert between units within the same system (e.g. 100 cm = 1 m so 2 m x 100 = 200 cm). The third learning target requires that students are able to effectively reason and problem solve when faced with real-world situations that require measurement, and that they are able to select an appropriate unit and justify that choice mathematically.

* 1. **Essential Question**

How do units of measuring length relate to one another and why should I choose to use a particular unit to represent a certain length?

**2. LEARNERS**

**2.1a Academic Development**

Schmitz Park Elementary uses a Walk-to-Math model, with students grouped by ability and by learning style. I will be teaching the group with the highest performing students who also are more self-directed learners and therefore can handle being in the largest math group consisting of twenty-six students. Despite being the highest achieving group, there is a wide range of abilities within this group of students, as well as a variety of learning styles and needs with some students needing more hands-on use of manipulatives while others are more prepared to grasp concepts abstractly. Most students in the class thrive on an interactive learning environment. Several students, including two students with ADHD, have issues sustaining focus for long periods of independent work time. The entire class excels when learning is centered on an engaging topic.

**2.1b Academic Language Development**

The class is well versed in academic language that is aligned with the 4th grade Common Core standards. I do not have any English Language Learners in my class. The students study Greek and Latin root words on a weekly basis so they are also proficient at decoding words for meaning using root words. The class likes interactive activities and so they have had plenty of practice with discourse, although respectful communication could be improved.

**2.1c Social and Emotional Development**

The 4th grade cohort has a reputation in the school for immaturity and unruly behavior. The girls in the class show more maturity and are natural leaders in academic settings, however during interactive experiences the boys in the class become more engaged and take on more leadership roles. Several students in this math group have anxiety issues during timed tests and in other high-pressure academic environments.

**2.1d Family/community/cultural assets**

Most students are from middle class backgrounds. The class has a high proportion of students with divorced parents, and in most cases both parents are involved in their student’s academics. There is racial and ethnic diversity in the class with several students from Latino, East African, Korean, and Chinese backgrounds, although the majority of the students are white.

**2.1e Dispositions related to the central focus.**

Although this is the highest performing math group, there is a wide range of dispositions towards math. There are several dominant students who always have their hand raised and always complete assignments as quickly as they can with a lot of self-assurance. These students are always very engaged in math lessons and take pride in their abilities, and I expect the same to be true in this unit on converting measurements. Other students lack confidence and are hesitant and unsure of their answers and exhibit a great deal of anxiety towards math and finding the “right answer.” They also tend to rely on the dominant students to lead the class. My hope is that with measurements of real-world objects these students are able to connect with the material and appreciate the purpose of learning measurement conversion and will gain confidence and appreciation for this important math skill.

**2.2 How this context for learning influences instructional strategies and learning tasks**

There will be several anchor charts around the room to provide visual displays of unit conversions, and to reinforce new academic vocabulary. Assignments will be structured to encourage students to use the new academic language in context, and my cooperating teacher and I will also be using this new vocabulary, both in written form and in oral communication, frequently throughout the unit. There is a strong connection between academic language in units of measurement (kilometer, decimeter, centimeter etc.) and the Greek and Latin roots lessons that occur in 4th grade so I will be sure to highlight kilo-, centi- and deci- during this unit of study.

I plan to offer frequent collaborative learning opportunities throughout this unit as I think these interactive learning environments help both my students who struggle with behavior and focus, and my students who struggle with confidence and anxiety. There will be hands-on learning and frequent opportunities for movement in class, as the 75 minute math block is a long time for 4th graders to sustain focus, particularly for my students with social-emotional or behavioral issues. Along with these interactions I will continue to explicitly teach the social skills of cooperation and respectful discourse, with additional scaffolding for my students with social-emotional issues. There will still be many times when I will intentionally be using direct instruction to teach new material, so I will structure short blocks of focused time, followed by more interactive learning. Formative assessments will be both group and individual, but summative assessments will all be individual so that I have a clear sense of each student’s understanding of new concepts and proficiency with new skills. For my students with anxiety I will provide additional time to complete assessments and offer them a quiet work space outside of the classroom that can relieve anxieties associated with comparing their own performance and progress on an assessment with their peers.

Finally, as a culturally responsive teacher I plan to differentiate instruction to meet the needs of each of my students by aligning curriculum with their lived experiences and background knowledge. This will include homework and family assignments that ask student to measure lengths and distances at home using the system of measurement that is used by their family. Because of the ethnic diversity in my classroom I expect many students will use the metric system, and validating the use of each system is a way to teach my students respect for difference. I want students to develop proficiency with and respect for both systems of measurement, and present the purpose for learning this important skill within the context of being global citizens.

**2.3 Family Connections**



March 28, 2016

Dear Families,

Next week in math we will begin learning how to convert units of measurement (e.g. kilometers to meters, miles to feet). This is one of the Common Core State Standards for 4th grade math, and is a really engaging unit as students explore both the metric system and the U.S. customary system through hands-on learning experiences measuring objects in the classroom, on the playground and at home. The goals of this unit are for students to develop proficiency converting units within both systems, and to develop a conceptual understanding of the relative sizes of each unit of measurement.

This is always a fun and engaging unit for our students and we want to include you in the learning as well. Your child will be bringing home two family activities. These are intended to be fun and easy ways for students to use their home life as a basis for understanding the conversion of units of measurement, and they’re designed to give you a fuller understanding of the skills and concepts your child is learning in the classroom.

Please feel free to contact me with any questions about the unit or about how you can further support your child’s learning. You are also always invited to join us in the classroom to experience it firsthand.

Sincerely,

Elsa Klein

Student Teacher

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Family Assignment #1: Understanding the Relative Sizes of Units of Measurement

In math class today we learned about the metric system and the customary system, and the units of measuring length that are used in each system. For your reference these are the units we will be exploring this week.

**Metric:** centimeter, meter, kilometer

**Customary:** inch, foot, yard, mile

It is always helpful to use objects in your daily life to develop a solid understanding of how large or small a given unit is. We often compare sizes of large objects to the size of a football field and small objects to the width of a fingernail, but we also want students to have these reference objects for each unit of measurement we’ll be using.

Together with your child, find something around your house or neighborhood that is representative of each of these units (e.g. our front step is about a meter wide, the walk from home to school is about a kilometer long). If you need to convert from metric to customary, or vice versa to understand how long a meter or yard might be, use this converter tool on Google: [bit.ly/1nFtJho](https://bit.ly/1nFtJho). Find objects that are meaningful to your child so that they connect with these representations and remember them. Fill in your examples in the spaces on the worksheet below.

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Family Member Name(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

METRIC SYSTEM

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 centimeter

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 meter

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 kilometer

U.S. CUSTOMARY SYSTEM

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 inch

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 foot

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 yard

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 mile

Family Assignment #2: Converting big distances into tiny inches

Over the last two days we have been learning how to convert lengths and distances within the metric and the customary systems. Tonight’s family activity allows you to continue to practice these skills with your child, while also developing fun connections to all of the tiny inches and centimeters you travel through in your daily life. This activity involves two-step conversions and allows you and your child to choose to use either the metric system or the customary system. If you need a refresher on the conversion formulas for either system, your child has that information in his/her Math Notebook to reference.

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Family Member Name(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Estimate the distance between your house and school in kilometers or miles:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (km or mi)

1. Convert that distance to either meters or feet.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (m or ft.)

1. Convert your answer from #2 to either centimeters or inches.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (cm or in.)

1. Now estimate the distance you traveled on your last family vacation.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (km or mi)

1. Convert that distance to either meters or feet.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (m or ft.)

1. Convert your answer from #2 to either centimeters or inches.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (cm or in.)

**3. INSTRUCTION**

**3.1i Title** **and Duration**

Lesson 1: Introduction to the units of length measurement, 60 minutes

**3.1ii Learning Targets and CCSS Alignment**

Lesson LTs: Students will understand that we use two distinct systems of measurement, the metric system and the customary system. (Concept)

Students will identify common objects that represent the lengths of the following primary units of measurement: centimeter, meter, kilometer, inch, foot, yard, and mile. (Skill)

Students will use these reference objects to understand the relative sizes of units of measurement. (Concept)

Unit LTs: Students will understand the relative sizes of units of measurement. (Concept)

Students will appreciate how using a variety of units gives us the ability to accurately measure objects and distances around us. (Disposition)

CCSS: 4.MD.A1. Know relative sizes of measurement units within one systems of units.

**3.1iii Evidence of Learning**

Students will identify objects or distances that are representative of each unit of measuring length (e.g. a fingernail is about a centimeter wide, a 1st grader is about a meter tall) as evidenced by their in-class scavenger hunt and their Family Assignment #1.

Students will list and group the three units we’ll use for measuring length in the metric system and the four units we’ll use for measuring length in the customary system on an exit ticket.

**3.2 Assessments**

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| --- | --- | --- | --- |
| **Learning Target(s)** | **Evidence of Learning** | **Assessment Instrument** | **Assessment Criteria** |
| Students will understand that we use two distinct systems of measurement, the metric system and the customary system. (Concept) | Students will list and group the three units we’ll use for measuring length in the metric system and the four units we’ll use for measuring length in the customary system on an exit ticket. | **Formative Assessment:** participation in class brainstorm  **Summative Assessment:** Exit ticket which requires students to list the three units of measurement we’ll use in the metric system and four units of measurement we’ll use in the customary system. | **Participation in class brainstorm:** I will keep track of which student contributed during our class brainstorm, and encourage quieter students to join in.  **Exit ticket:** Students will receive one point for each unit of measuring length they list, and one additional point for each unit that is placed in the correct column (metric or customary) for a total of 14 points possible. |
| Students will identify common objects that represent the lengths of the following primary units of measurement: centimeter, meter, kilometer, inch, foot, yard, and mile. (Skill)  Students will use these reference objects to understand the relative sizes of units of measurement. (Concept) | Students will identify objects or distances that are representative of each unit of measuring length as evidenced by their in-class scavenger hunt and their Family Assignment #1. | **Formative Assessment:** In-class scavenger hunt for representative items.  **Summative Assessment:** Family Assignment #1 | **In-class scavenger hunt:** I will review the worksheet that groups complete for accuracy of measurements and relatability of representative items.  **Family Assignment #1:** See Checklist 1 below for grading criteria |
| --- | --- | **Pre-Assessment** | I will use the Chapter 12 Pre-Assessment to gain understanding of students’ prior knowledge. Students must get 80% of the answers correct. |

**Exit Ticket Checklist**

\_\_\_\_\_ One point for each unit of measurement listed (7 points possible)

\_\_\_\_\_ One point for each unit of measurement listed under the correct system (7 points possible)

\_\_\_\_\_ TOTAL (14 possible points)

**In-Class Scavenger Hunt Checklist**

\_\_\_\_\_ Students provided accurate examples of objects that represent units of measuring length.

\_\_\_\_\_ Students chose objects that could be easily remembered and were relatable.

\_\_\_\_\_ Students in the group exhibited active listening skills as they worked cooperatively.

**Family Assignment #1 Rubric**

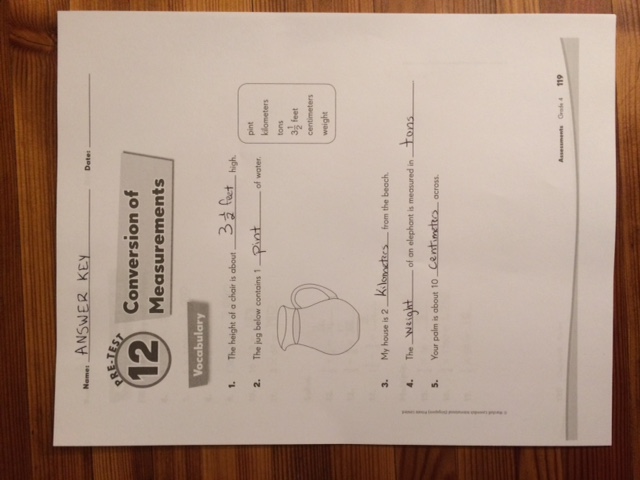
\_\_\_\_\_ Students found representative objects or distances for each of the seven units of measurement. (2 points for each item)

\_\_\_\_\_ Students used representative objects or distances that have personal connections to their home life. (1 point for each item)

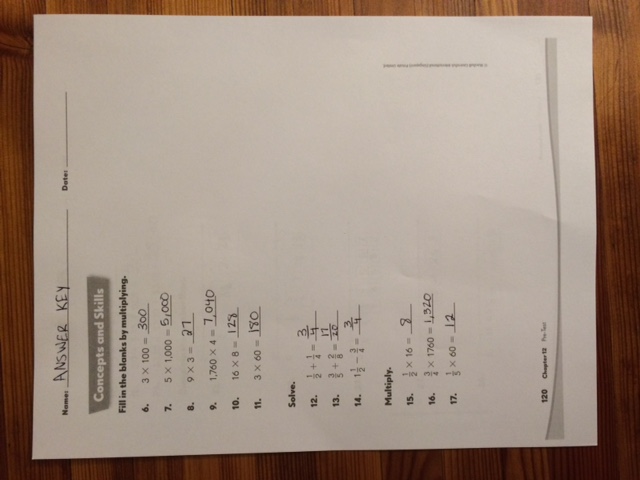
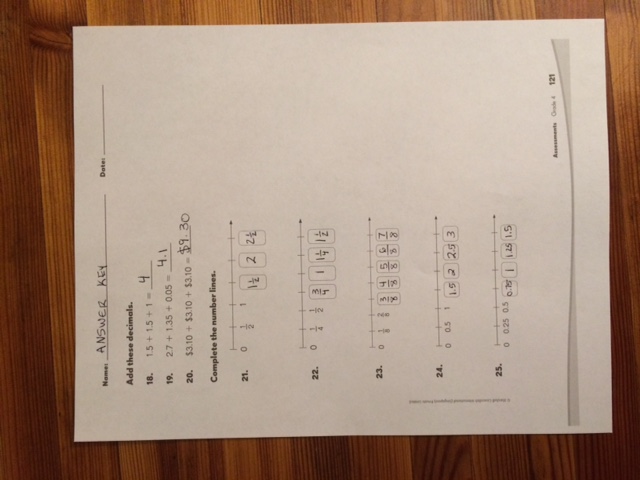
\_\_\_\_\_ Students and family members participated together in this activity (1 point)

\_\_\_\_\_ TOTAL (22 points possible)

**Chapter 12 Pre-Assessment Answer Key**

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(continued on next page)

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**3.3i Narrative of Lesson**

When students enter the classroom there will be a Pre-Assessment on their desk which they will have about 15 minutes to complete. The pre-assessment gauges students’ prior knowledge on units of measurement learned in 3rd grade as well as mathematical skills learned in 4th grade that are required in these upcoming lessons on unit conversion such as addition and multiplication of fractions and decimals, and placing fractions and decimals on number lines. As students are working I will review their answers and re-teach skills if necessary based on student performance. Next I will read-aloud “One Inch Tall” by Shel Silverstein which is a poem written from the perspective of someone who is one inch tall and views all things in their world as relatively HUGE. We will have a brief class discussion about the poem and use it to introduce the concept of relative size. As a class we will then brainstorm measurements of length and create an anchor chart. As students brainstorm units I will classify them into two columns on our chart for metric and customary. I will then show students tools that are used to measure each unit (cm on a ruler, m on a meter stick, km on a measuring wheel). Students will then be given pieces of string that are 1 cm, 1 m, 1 in., 1 ft., and 1 yd. long and with a partner they will complete the scavenger hunt worksheet by finding objects in the classroom that are approximately that size. Students will then take home Family Activity #1 and complete a similar exercise with their parents so that they have a sense of each unit’s relative size in relation to an object they use in their everyday life at home or school. We will conclude the day with a discussion based on the question, “What is the purpose of learning the systems of measurement and converting between units?”

**3.3ii Resources and Materials**

Anchor chart and markers

Tools for measuring units of length: ruler, meter stick, measuring wheel

Pieces of string cut into 1 cm, 1 m, 1 in., 1 ft. and 1 yd. pieces

In-class units of measurement scavenger hunt worksheet

Family Assignment #1 & Exit ticket

**3.3iii Co-Teaching Strategies**

One teach, one assist

**3.1i Title and Duration**

Lesson 2: Unit conversion within the metric system, 75 minutes

**3.1ii Learning Targets and CCSS Alignment**

Lesson LTs: Students will convert metric units of measuring length from larger units to smaller units. (Skill)

Students will understand that converting between units in metric involves the base-10 system. (Concept)

Unit LTs: Students will convert units of length within the metric system and within the customary system. (Skill)

Students will appreciate how using a variety of units gives us the ability to accurately measure objects and distances around us. (Disposition)

CCSS: 4.MD.A.1. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

**3.1iii Evidence of Learning**

Students will convert kilometers to meters and meters to centimeters by completing conversion problems with at least 80% accuracy.

Students will depict the relative size of a kilometer and meter, and a meter and centimeter using base-10 blocks.

**3.2 Assessments**

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Target(s)** | **Evidence of Learning** | **Assessment Instrument** | **Assessment Criteria** |
| Students will convert metric units of measuring length from larger units to smaller units. (Skill) | Students will convert kilometers to meters and meters to centimeters by completing problems with at least 80% accuracy. | **Formative Assessment:** participation and accuracy during whiteboard activity and partner work.  **Summative Assessment:** Homework is workbook pp. 99-104 to gain procedural fluency with converting metric units. | **Participation in guided practice:** I will monitor students’ answers during our whiteboard and partner activities to assess how well each student is applying the concept of conversion.  **Homework:** Students must receive an 80% or above on their homework converting metric units. I have chosen an 80% benchmark because Rosenshine (2012) said that was a good standard to provide a balance of success and challenge (p. 17). |
| Students will understand that converting between units in metric involves the base-10 system. (Concept) | Students will depict the relative size of a kilometer and meter, and a meter and centimeter using base-10 blocks. | **Formative Assessment:** In-class activity using base-10 blocks to show the relationship between kilometers and meters (1000 to 1) and meters to centimeters (1 to 1/100) | **In-class base-10 activity:** I will review students’ depictions of kilometers to meters (1 cube to 1 unit block) and meters to centimeters (1 flat to 1 unit block) to confirm they have understood the relative size and the connection between the metric system and the base-10 system. Students will have to justify their use of the appropriate base-10 blocks in their math notebooks. I will review those justifications to determine whether it aligns with their base-10 representations, uses academic vocabulary, and shows understanding of the relationship between the base-10 system and the metric system. |

**In-class base-10 Activity Checklist:**

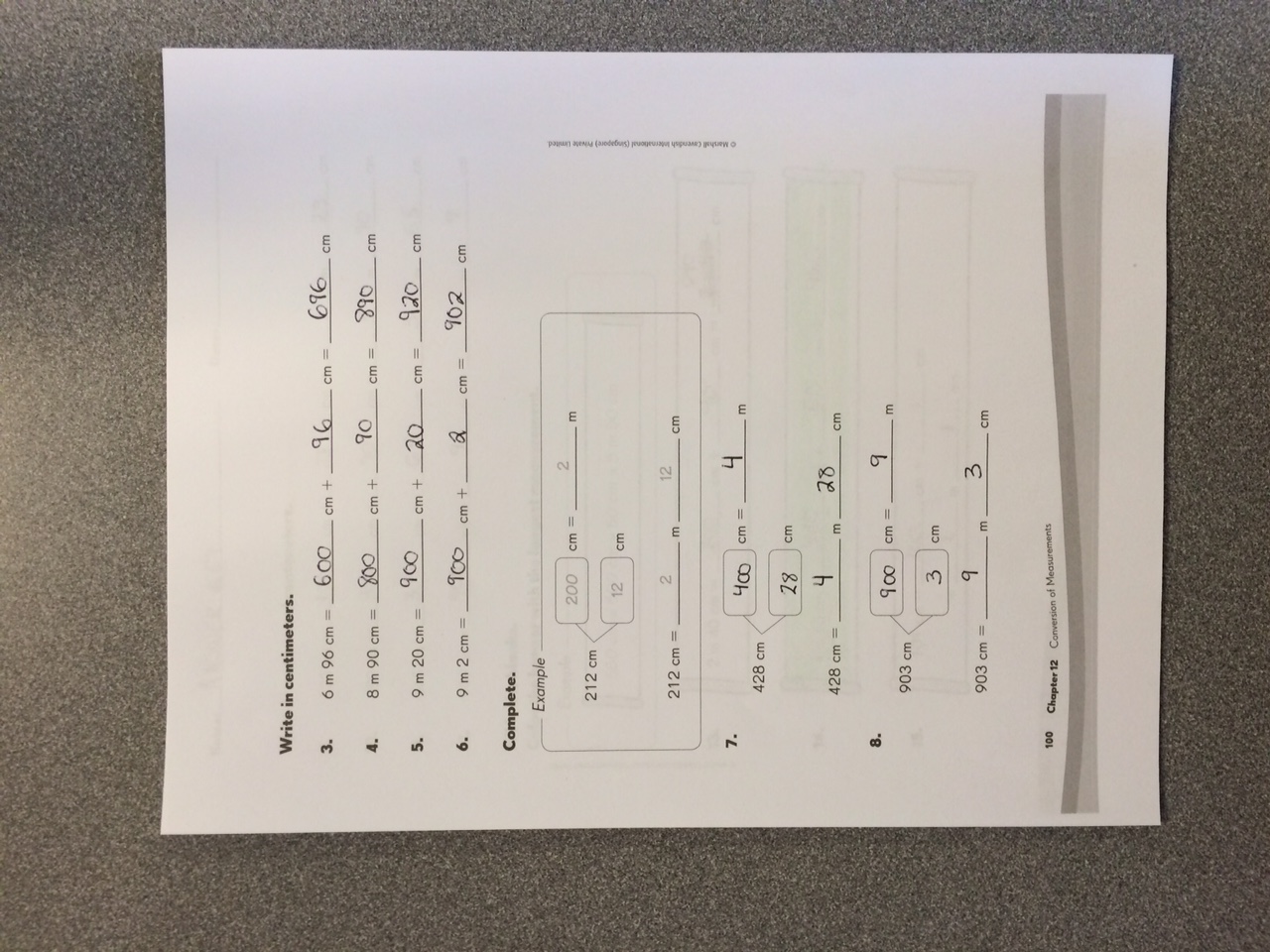
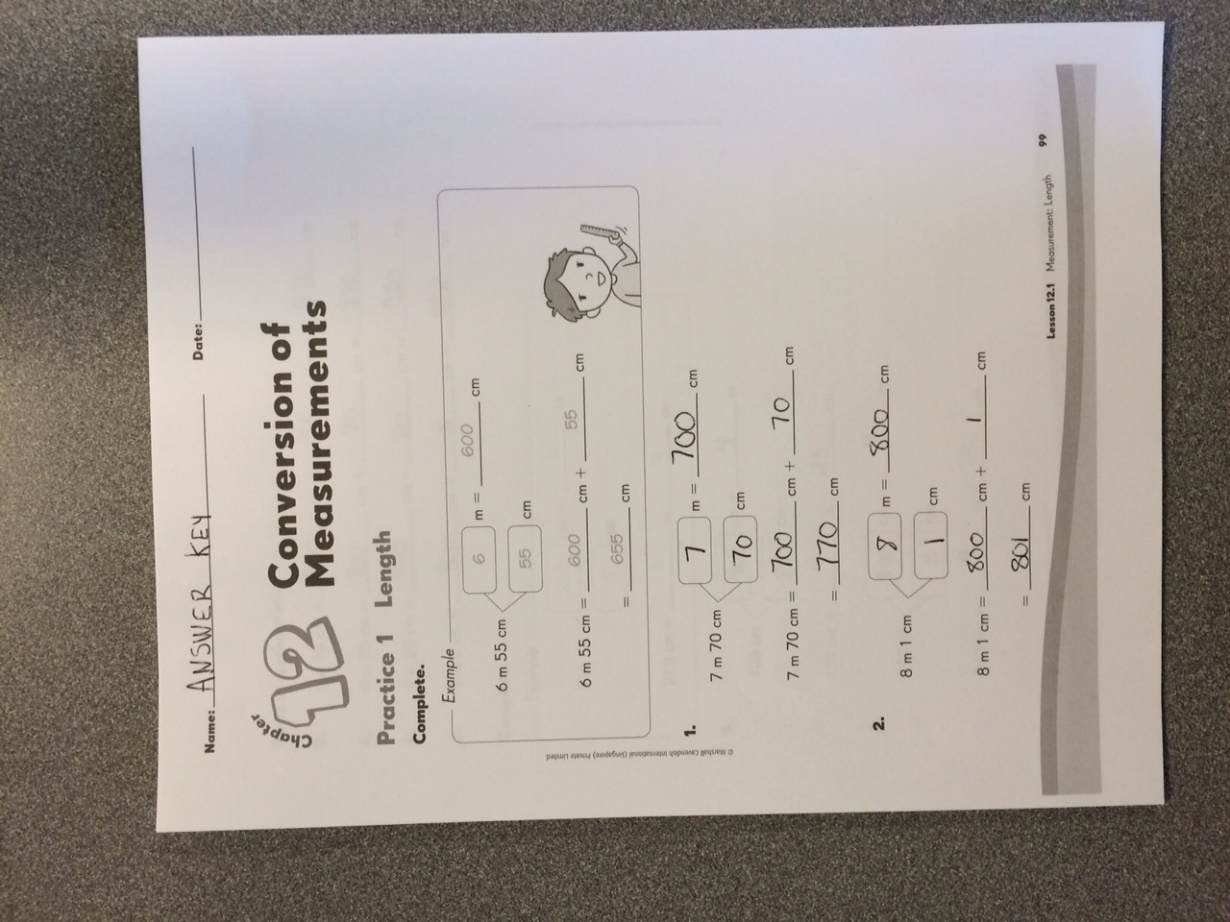
\_\_\_\_\_ Student accurately represented kilometers to meters with base-10 blocks (1 cube to 1 unit block).

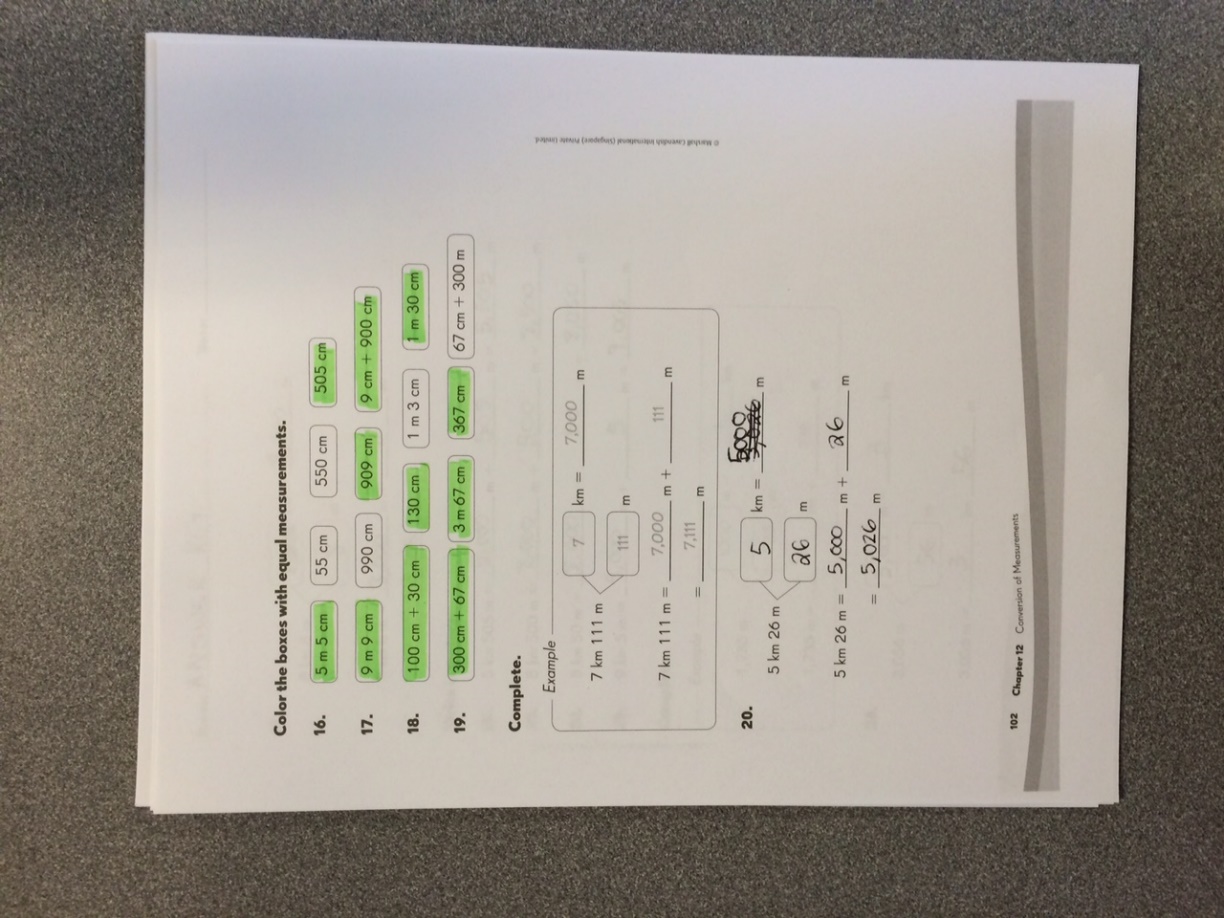
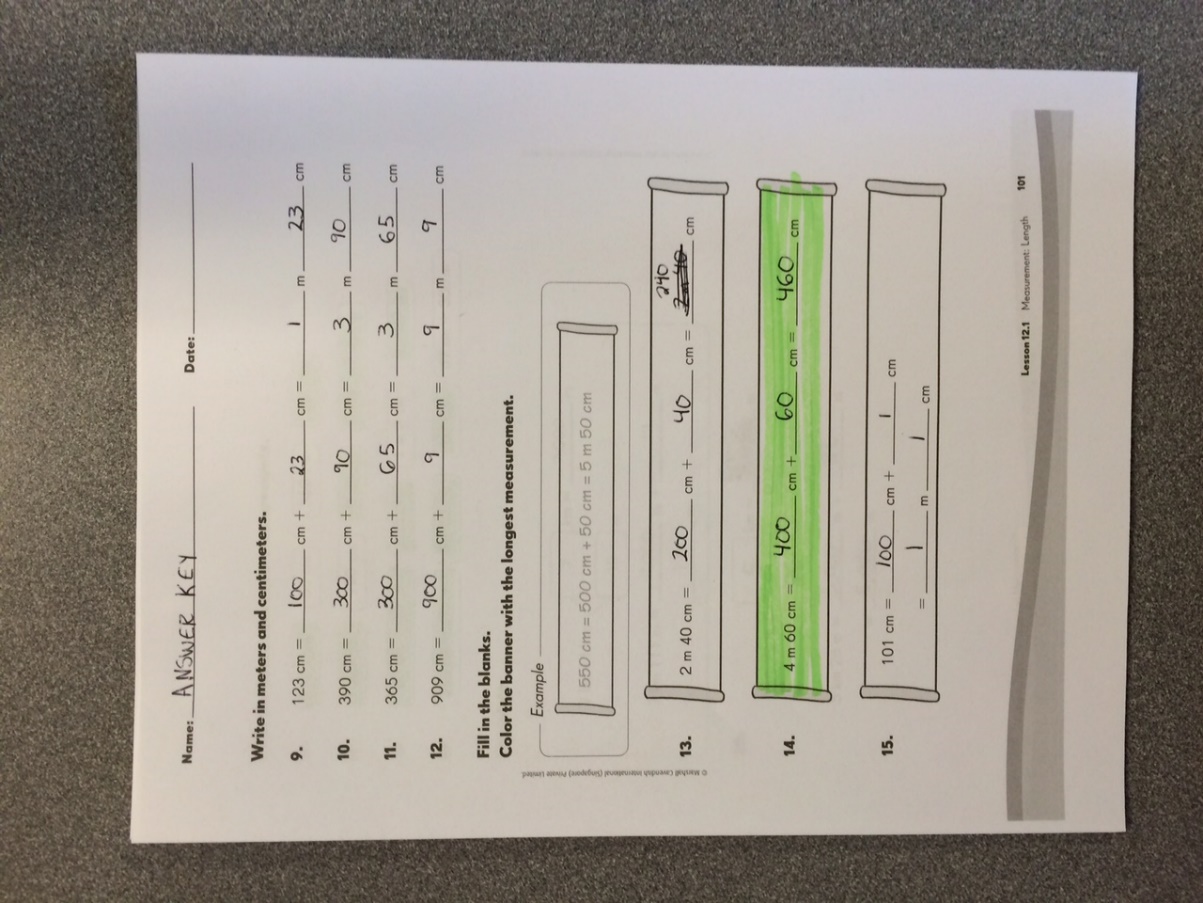
\_\_\_\_\_ Student accurately represented meters to centimeters with base-10 blocks (1 flat to 1 unit block, or 1 cube to 1 rod).

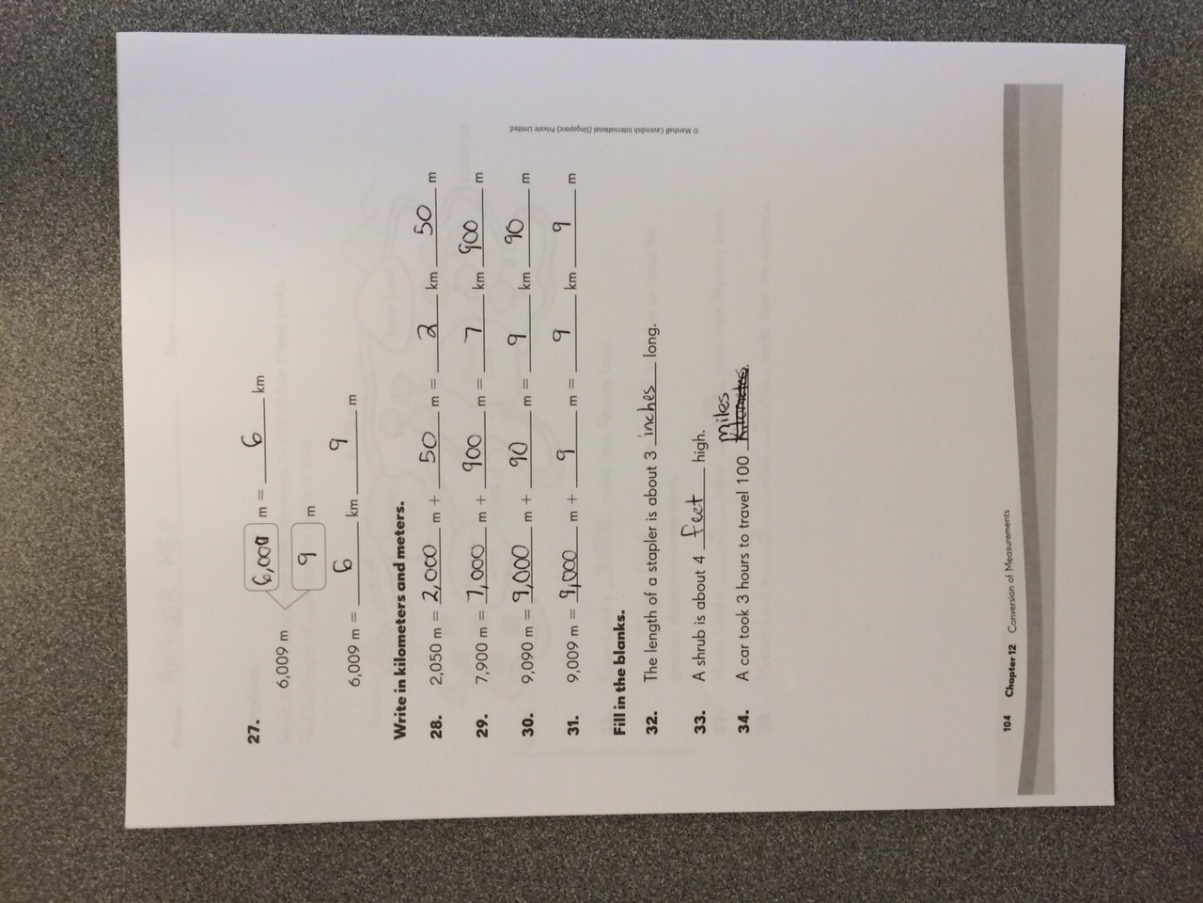
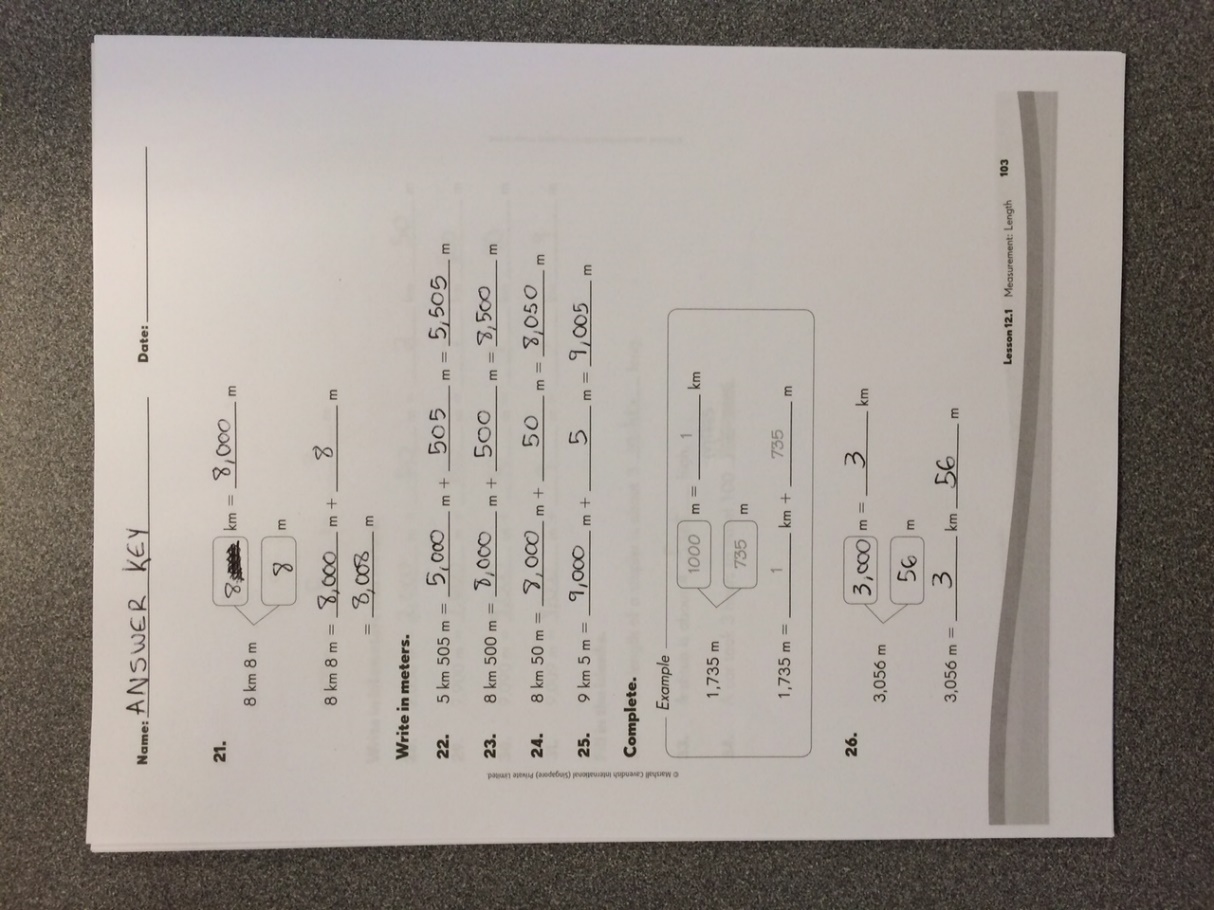
\_\_\_\_\_ Student’s justification aligns with their base-10 representation.

\_\_\_\_\_ Student’s justification uses academic language and shows a conceptual understanding of the relationship between the base-10 system and the metric system.

**Homework Answer Key**

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**3.3i Narrative of Lesson**

I will begin the lesson by writing the metric conversion factors between meters and centimeters on the board. I will use examples from students’ family assignments to convert to smaller units (1 meter long guitar is 100 centimeters). Although it is outside of the scope of this curriculum I will briefly show students a visual representation of stairs demonstrating the entire metric system (kilometer, hectameter, dekameter, meter, decimeter, centimeter, and millimeter) changing by a power of 10 with each step. I will highlight km, m, and cm as the most commonly used units and handout the foldables that students will paste into their math notebooks with the metric unit conversions. Students will use these conversions to demonstrate with base-10 blocks the relationships between kilometers and meters, and meters and centimeters, and will write a rationale for how they represented the units in their math notebooks. Next I will use relatable objects or distances in kilometers or meters (distance between school and Alki beach, distance between portable classroom and the bathroom in the school), and using whiteboards have students convert to the smaller unit. I will include measurements with mixed units (e.g. 6m 55cm) in the later part of this activity as a challenge. After providing one mixed unit conversion problem I will stop and teach students how to convert these into one unit, and then we will continue with whiteboard practice. As students gain confidence and proficiency I will have them suggest objects or distances and have the class estimate the length or distance and then convert. As the final exercise I will teach how to convert measurements with fractions (e.g. 7/8 m to cm) and have students complete guided learning activities on pp. 159-160 of their book with a partner.

**3.3ii Resources and Materials**

Stair-step visual representation of the entire metric system

Foldables with metric conversions for students’ Math notebooks

Whiteboards and dry erase markers for each student.

**3.3iii Co-Teaching Strategies**

One teach, one assist

**3.1i Title and Duration**

Lesson 3: Unit conversion within the customary system, 75 minutes

**3.1ii Learning Targets and CCSS Alignment**

Lesson LTs: Students will convert customary units of measuring length from larger units to smaller units. (Skill)

Students will solve simple word problems requiring conversion within the customary system. (Skill)

Unit LTs: Students will convert units of length within the metric system and within the customary system. (Skill)

Students will appreciate how using a variety of units gives us the ability to accurately measure objects and distances around us. (Disposition)

CCSS: 4.MD.A.1. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

4.OA.A.2. Multiply or divide to solve word problems involving multiplicative comparisons.

**3.1iii Evidence of Learning**

Students will convert miles to yards, miles to feet, yards to feet, and feet to inches by completing conversion problems with 80% accuracy.

Students will solve one-step word problems requiring conversion within the customary or the metric system with an accuracy of 70% on customary conversions and 85% on metric conversions.

**3.2 Assessments**

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Target(s)** | **Evidence of Learning** | **Assessment Instrument** | **Assessment Criteria** |
| Students will convert customary units of measuring length from larger units to smaller units. (Skill) | Students will convert miles to yards, miles to feet, yards to feet, and feet to inches by completing Homework problems with 80% accuracy. | **Formative Assessment:** participation and accuracy during partner work.  **Summative Assessment:** Homework is workbook pp. 105-107 and Family Activity #2 to gain procedural fluency with converting customary units. | **Participation in guided practice:** I will monitor students’ answers during our partner activity to assess how well each student is applying the concept of conversion.  **Homework:** Students must receive an 80% or above on their homework converting customary units.  **Family Activity #2**:This worksheet will be assessed for accuracy and participation. |
| Students will solve simple word problems requiring conversion within the customary system. (Skill) | Students will solve one-step word problems requiring conversion within the customary or the metric system with an accuracy of 70% on customary conversions and 85% on metric conversions. | **Summative Assessment:** In-class activity solving one-step word problems using conversions within the metric system and within the customary system. | **Word Problems:** Students will be expected to complete word problems with an accuracy of 70% on customary conversions and 85% on metric conversions. |

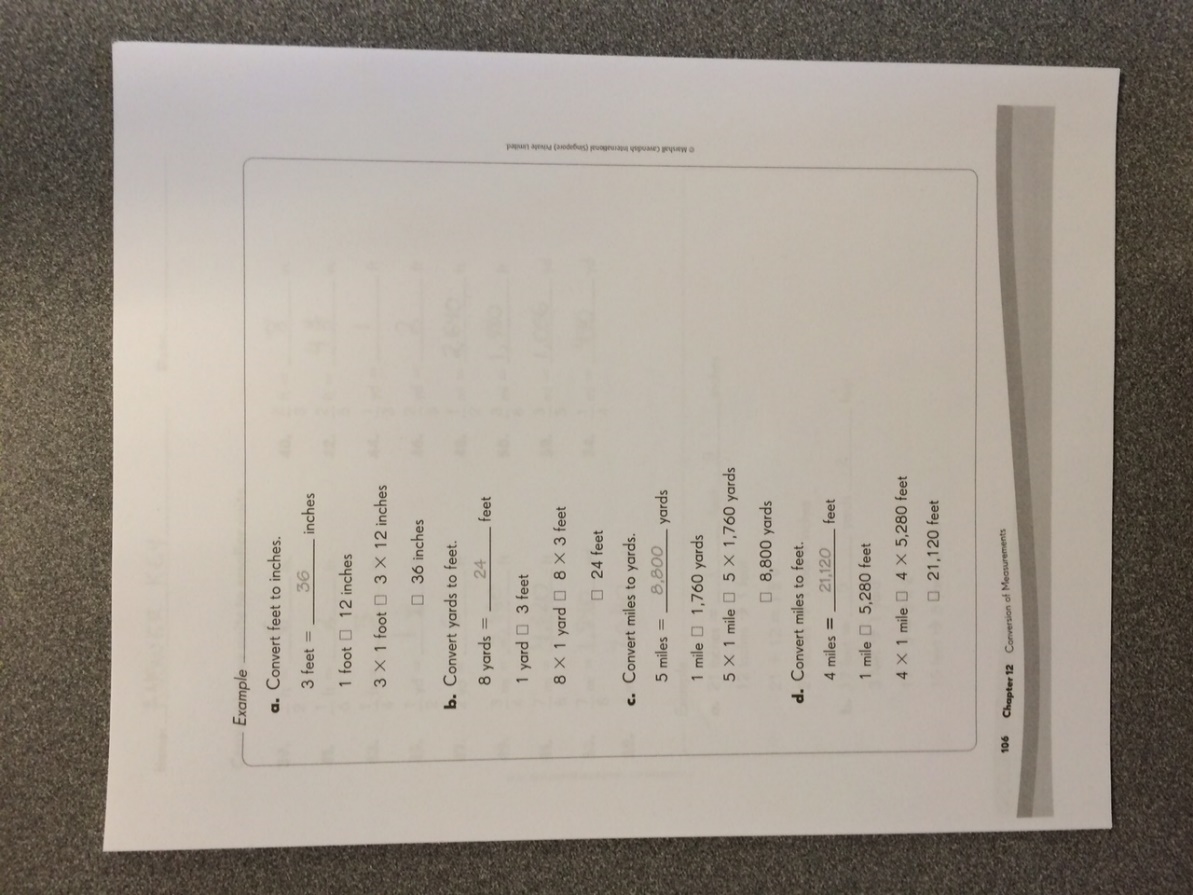
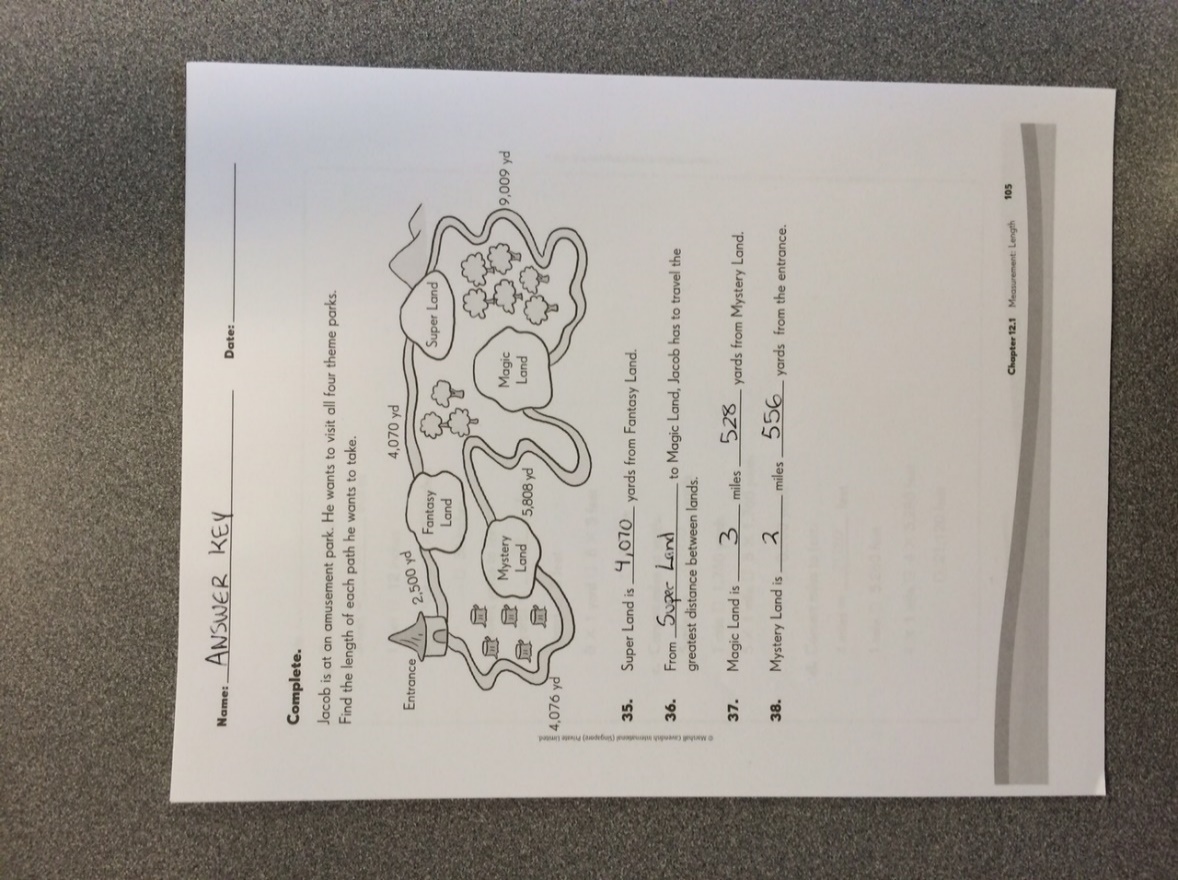
**Family Activity #2 Checklist**

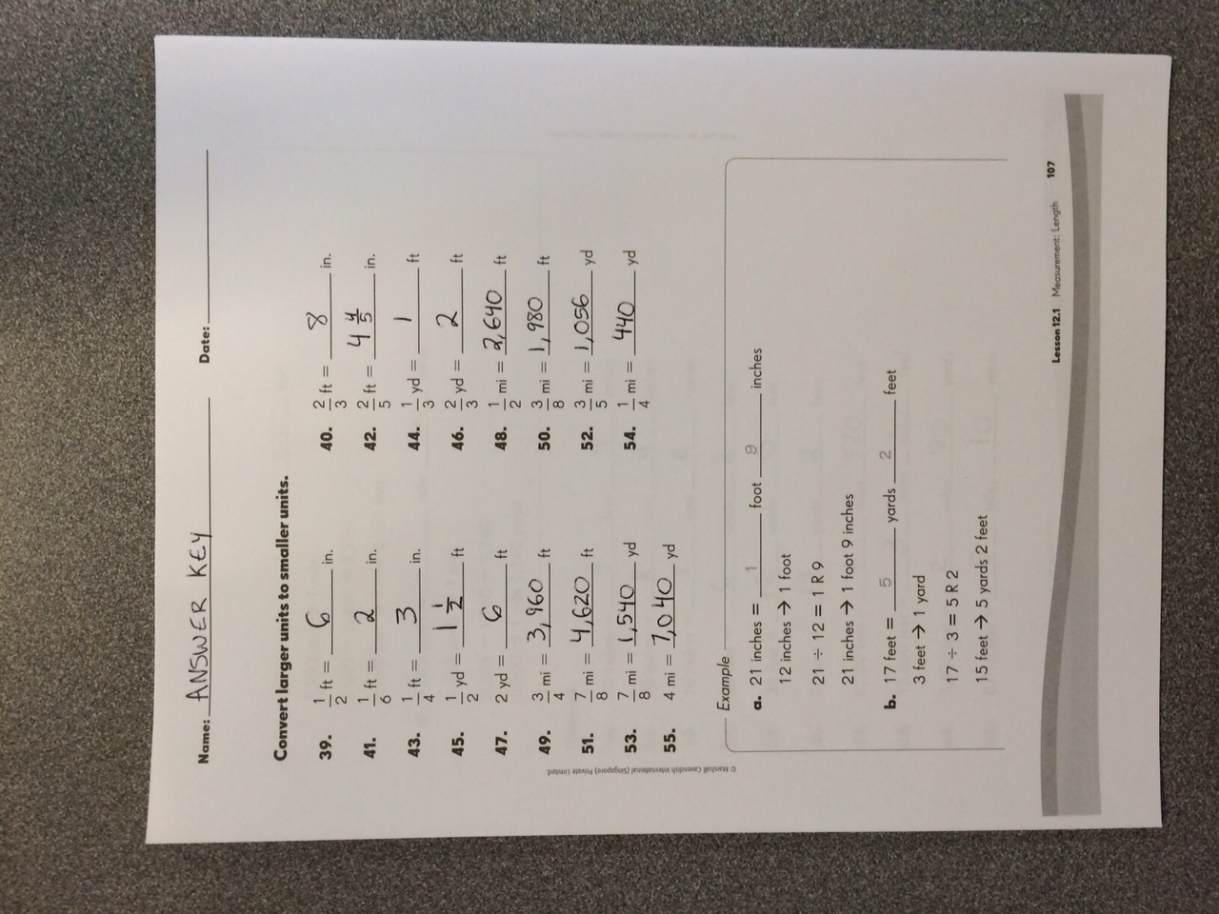
**\_\_\_\_\_** Estimates on distances between school and home and between home and vacation were accurate.

\_\_\_\_\_ Two-step conversions between units were done accurately.

\_\_\_\_\_ Students and family members participated in the learning exercise.

**Homework Answer Key**

****

****

**Word Problems Answer Key**

1. The average 4th grader is 4 feet 6 inches tall. How tall is that in inches?

54 inches

1. We will travel 10 miles on the ferry to Bainbridge Island for our Islandwood field trip. How many yards will the ferry boat travel?

17,600 yards

1. Our bus will drive 10 kilometers from school to the ferry terminal. How many meters will our bus drive?

10,000 meters

1. Mirabel’s house is 16 meters from school. How many centimeters is her house from our school?

1,600 centimeters

1. Our new school building is 300 yards from our current school building. How many feet away is our new school building?

900 feet

1. I had to walk 1 mile to the grocery store to buy cupcakes for a class treat today. How many feet did I walk?

5,280 feet

1. Enzo plays a drum set that is 1 meter high. How many centimeters high is his drum set?

100 centimeters

1. Our principal, Mr. Kischner, is 6 feet tall. How tall is he in inches?

72 inches

**3.3i Narrative of Lesson**

I’ll introduce the lesson by writing the conversion formulas for length measurements in the customary system on the board. Students will be asked to make observations and comparisons between these conversions and the metric conversions. I will then do a read-aloud of *Millions to Measure*, a picture book about the history of our measurement systems. I will then pass out foldables of the conversion factors in the customary system that can be pasted into their Math Notebooks. On the board I will then demonstrate conversions using the conversion formulas I just introduced, and we will do a few practice problems as a group. Then students will get into pairs and create conversion problems for their partner (e.g. 4 miles is how many feet?) and will be encouraged to use measurements with fractions and multiple units (3 miles 25 feet is how many feet?). Next students will answer one-step word problems using both conversions within the metric system and within the customary system. These word problems will be written to make personal connections to the students, such as using their names and local landmarks to capture interest. Their answers will be turned in as a summative assessment of students’ application of these concepts and skills in simple word problems. I will then hand out Family Assignment #2 and assign workbook pages 105-107 for homework. Students will also be encouraged to play a few rounds of a measurement conversion computer game <http://www.mathnook.com/math/measurementmania.html> which will improve procedural fluency, and encourages students to start doing these conversions in their heads.

**3.3ii Resources and Materials**

*Millions to Measure* read-aloud book

Foldables with customary unit conversions

Word problems handout

Family Assignment #2

**3.3iii Co-Teaching Strategies**

One teach, one assist

**3.1i Title and Duration**

Lesson 4: Converting smaller units to larger units, 75 minutes

**3.1ii Learning Targets and CCSS Alignment**

Lesson LTs: Students will convert smaller units of measuring length to larger units. (Skill)

Students will understand that multiplication and division are inverse operations. (Concept)

Unit LT: Students will convert units of length within the metric system and within the customary system.

CCSS: 4.MD.A.1. Record measurement equivalents in a two-column table.

**3.1iii Evidence of Learning**

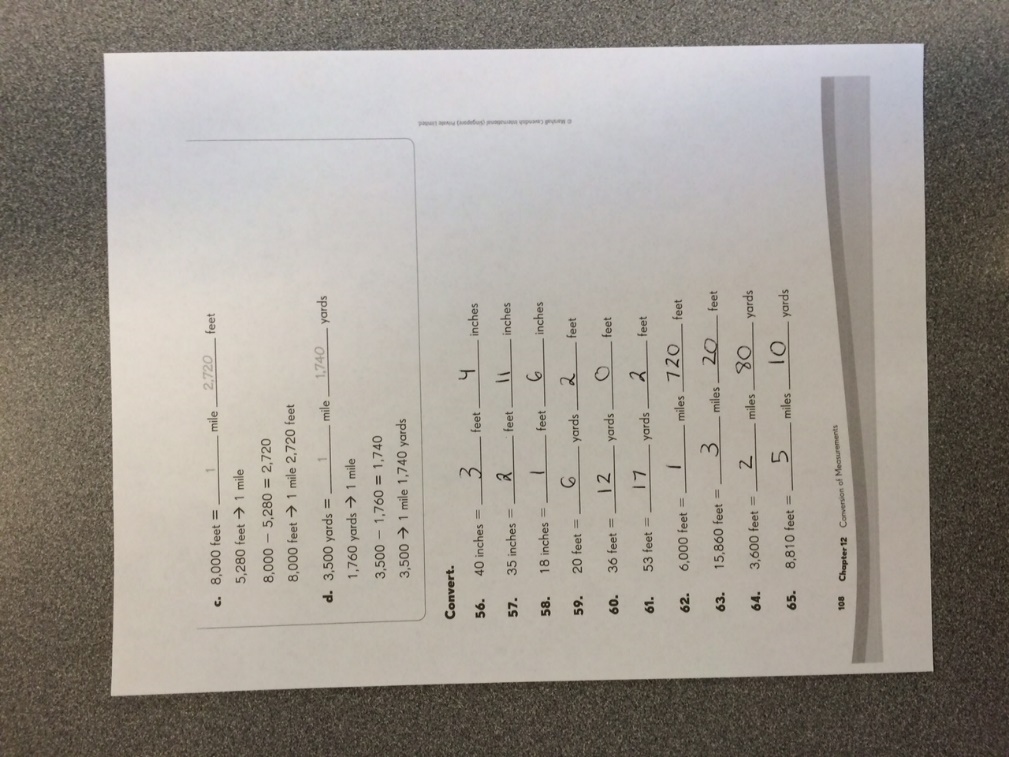
Students will convert smaller units of measurement to larger units of measurement in both the metric and the customary systems by completing conversion problems with 80% accuracy.

Students will provide a written explanation in their math notebook about how to convert from smaller units to larger units and a rationale for why the operation for this conversion is different than the operation used for conversions of larger units to smaller units.

**3.2 Assessments**

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Target(s)** | **Evidence of Learning** | **Assessment Instrument** | **Assessment Criteria** |
| Students will convert smaller units of measuring length to larger units. (Skill) | Students will convert smaller units of measurement to larger units of measurement in both the metric and the customary systems by completing conversion problems with 80% accuracy. | **Formative Assessment:** participation and accuracy during partner work.  **Summative Assessment:** Homework is workbook p. 108 to gain procedural fluency with converting smaller units to larger units. | **Participation in guided practice:** I will monitor students’ answers during our partner activity to assess how well each student is applying the concept of conversion.  **Homework:** Students must receive an 80% or above on their homework converting smaller units to larger units. |
| Students will understand that multiplication and division are inverse operations. (Concept) | Students will provide a written explanation in their math notebook about how to convert from smaller units to larger units and a rationale for why the operation for this conversion is different than the operation used for conversions of larger units to smaller units. | **Summative Assessment:** Written explanation and rationale in their math notebooks | **Math Notebook:** I will read the written responses and evaluate them based on clarity in the explanation of how to convert smaller units to larger units, clear and mathematically sound rationale for why the operation is different for this conversion, and recognition of multiplication and division being inverse operations. |
| Students will understand the relative sizes of units of measurement. (Concept)  Students will convert units of length within the metric system and within the customary system. (Skill)  Students will appreciate how using a variety of units gives us the ability to accurately measure objects and distances around us. (Disposition) | On the chapter 12 test students will demonstrate their understanding of the three unit learning targets by providing examples of representative items that demonstrate the relative size of units, by converting units of length within the metric system and within the customary system, and by selecting the appropriate unit of measurement to measure a given length and by providing a clear rationale to support their selection. | **Summative Assessment:** Modified chapter 12 test. The Chapter 12 test includes unit conversions for mass, volume, and time as well as length so assessment for this mini-unit will only be on a subset of the chapter 12 test questions, as well as the additional questions included below.  **Self-Assessment:** Students will complete a self-assessment to share their understanding of the purpose of the unit, evaluate their effort and participation, and confirm their conceptual understanding of unit conversion. | **Modified Chapter 12 Test**: Students will demonstrate their understanding of the unit learning targets by achieving at least an 80% grade on the modified chapter 12 test. Their tests will also be graded on a rubric to assess overall exhibition of conceptual understanding, accuracy, reasoning, and conventions so as to find broad gaps in a student’s mathematical ability in any of these categories.  **Self-Assessment:** The self-assessment will be reviewed and used to inform my teaching of the remainder of chapter 12 on unit conversions of mass, volume and time. |

**Homework Answer Key**



**Math Notebook Checklist**

\_\_\_\_\_ Student’s explanation clearly explains the steps to convert a smaller unit to a larger unit.

\_\_\_\_\_ Student’s explanation uses academic language and shows a conceptual understanding of conversion of smaller units to larger units.

\_\_\_\_\_ Student’s rationale is clear and mathematically sound and explains why the operation used is different for this conversion.

\_\_\_\_ Student’s rationale provides recognition of multiplication and division being inverse operations.

**Modified Chapter 12 Subtest Answer Key and Rubric**

I will grade the chapter 12 subtest on length to see if students achieved at least 80% accuracy. Then I will use the rubric below the answer key to assess students’ overall understanding and mathematical skills based on the categories of conceptual understanding, accuracy, reasoning and conventions. I’m using this rubric as a tool to identify holes that may be emerging in students’ mathematical development that may not otherwise be apparent by grading a test for percent correct.

**CHAPTER 12 CONVERSION OF MEASUREMENTS**

**SUB-TEST ON LENGTH UNITS**

***ANSWER KEY***

1. The length of a cell phone is measured in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. *Centimeters*
   2. Meters
   3. Kilometers
   4. Feet
2. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is approximately 1 meter long.
   1. Swimming pool
   2. *Guitar*
   3. Paperclip
   4. Foot
3. Convert three miles to yards.
   1. 300 yd.
   2. 3,000 yd.
   3. *5,280 yd.*
   4. 30,000 yd.
4. 9 feet = \_\_\_\_\_\_\_*108*\_\_\_\_\_\_\_\_\_ inches
5. 36 inches = \_\_\_\_\_*3*\_\_\_\_\_\_\_\_ feet
6. 8 yards = \_\_\_\_\_\_\_*24*\_\_\_\_\_\_\_\_ feet
7. ¾ kilometer = \_\_\_\_\_\_*750*\_\_\_\_\_\_\_\_\_ meters
8. 7 meters = \_\_\_\_\_\_*700*\_\_\_\_\_\_ centimeters
9. 2 miles = \_\_\_\_\_*10,560*\_\_\_\_\_\_\_\_ feet
10. Alice walked ½ mile from school to Alki beach. How many feet did she walk?

*2,640 ft.*

1. Our bus drove 10 kilometers on our field trip to the Seattle Art Museum. How many meters did our bus drive?

*10,000 m*

1. The Seahawks football field is 100 yards long. How many feet long is the field? How many inches is the field?

*300 ft. 3,600 in.*

1. What unit would you use to measure the distance between our classroom and the lunchroom?

*Meters or feet*

1. What unit would you use to measure the length of your Math Notebook?

*Centimeters or inches*

1. What unit would you use to measure the distance between our school and the state capitol in Olympia?

*Kilometers or miles*

1. Explain why we use different units to measure different objects.

*Answers will vary but should focus on the importance of choosing the appropriate unit for the relative size of the object or distance being measured.*

1. Why is it important to know how to convert units in both the metric and the customary systems?

*Answers will vary but could include international travel, trade with other countries, communication with people from different countries, awareness of the two systems and when to use one versus the other etc.*

**MODIFIED CHAPTER 12 TEST RUBRIC**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 3: Above Standard | 2: At Standard | 1: Below Standard |
| Conceptual Understanding  *(Questions 1, 2, 13, 14, 15, 16, 17)* | Student demonstrated a deep conceptual understanding by providing detailed responses about the relative sizes of units and the application of these skills to real-world contexts. | Student demonstrated a conceptual understanding of the relative sizes of units with a brief but complete response. Student was able to provide a one sentence response to real-world applications of these skills. | Student did not show a conceptual understanding of unit conversion. There was no consistency in answers, the student could not relate the skills to real-world applications, and the student had no sense of the relative sizes of units. |
| Accuracy  *(All questions)* | Student showed evidence of correcting or double-checking his/her answers for accuracy. | Student showed evidence of attempting to review responses for accuracy. | Student clearly made no attempt to review his/her responses for accuracy. |
| Reasoning  *(Questions 16, 17)* | Student exhibited above grade-level reasoning skills, with clear, thoughtful and mathematically sound responses. | Student exhibited at grade-level reasoning skills with mostly coherent and mathematically sound responses. | Student exhibited below grade-level reasoning skills with responses that were unclear, and not aligned with mathematical concepts. |
| Conventions  *(All questions)* | Student’s work was extremely well organized, detailed and free from errors. | Student’s work was organized, most of his/her thinking was shown, and responses were free from major errors. | Student’s work was messy, disorganized and had several careless mistakes. |

**Self-Assessment Checklist and Questionnaire**

As we wrap up our study of converting measurements of length I want you to reflect on your learning and share some information with me so that we can work together to further our learning as we continue in this measurement conversion unit with volume, weight and time.

Circle the number of smiley faces that reflects your feelings on the following statements with 4 smiley faces being “Yes, definitely!” and 1 smiley face being “No way!”

☺ ☺ ☺ ☺ I can confidently convert units of length in the metric system.

☺ ☺ ☺ ☺ I can confidently convert units of length in the customary system.

☺ ☺ ☺ ☺ I think I will be able to apply these skills to converting other types of measurement (volume of liquid, weight of objects).

☺ ☺ ☺ ☺ I understand the relative sizes (how big or how small) of each unit of measurement.

☺ ☺ ☺ ☺ I used perseverance to solve challenging problems.

☺ ☺ ☺ ☺ I improved my problem-solving skills in this unit.

☺ ☺ ☺ ☺ I liked being able to work with my classmates to solve problems.

What do you think is the purpose of converting units of measurement?

Provide one example of how you will use unit conversion in your daily life.

**3.3i Narrative of Lesson**

I will introduce the lesson by telling students that today we are going to be converting smaller units to larger units. I will hand small groups a yard stick and have them make a two-column table of how many inches are in three feet, how many inches are in two feet, and how many inches are in one feet. Students will then be asked to find patterns and will likely discover that division is needed to convert smaller units to larger units. I will then demonstrate this formula on the board and provide some examples. Students will then work in pairs to complete guided learning exercises. Next, individual students will be asked to complete two-column tables for several smaller to larger unit conversions. Students will then complete workbook pp. 108-110 for homework.

Students will take the chapter 12 test at the end of the larger unit on measurement conversion. The summative assessment for this mini-unit on converting measurements of length will include selected questions from this chapter test as well as supplemental questions I include to assess students’ reasoning ability and conceptual understanding.

**3.3ii Resources and Materials**

Yardsticks

Two-Column table handout

Chapter 12 modified sub-test

**3.3iii Co-Teaching Strategies**

One teach, one assist

**4. ANALYSIS AND REFLECTION**

**4.1 Connection to Research**

I have established a bidirectional flow in my lessons between conceptual understanding and procedural fluency, following Sally Roberts’ (2010) “Ebb and Flow” approach and acknowledging the “dynamic relationship” that exists between the two (p. 197). Early in most lessons I provide students with the conversion formula for the units we are studying. I do this intentionally as a way to give students the tools to develop their conceptual understanding. Having these algorithms as a starting point allows my students to focus on interpreting the conceptual meaning of unit conversions and then apply that to solving problems (Chapin & Johnson, 2006, p. 43). Following this Ebb and Flow model, I have also decided to first fully develop conceptual understanding and procedural fluency in converting larger units to smaller units, and then to have them use this knowledge to discover how to convert smaller units to larger units in the fourth lesson. This progression allows my students to develop confidence and proficiency with one form of conversion and prevents them from being overloaded and confused by converting units in both directions. Once they have gained this solid foundation of unit conversion in one direction, it will then be easier to transfer those skills to converting units in the other direction.

I’ve then structured cooperative learning opportunities so that students can work with their peers to expand their own understanding, learn from their classmates, and cooperatively solve problems (Burns, 2007, p. 194). Cooperative learning activities require discourse between students which helps develop their reasoning skills. I also am requiring that students write rationales for mathematical problems in their math notebooks, but will always allow for partner conferencing before they write so that they can practice presenting their thinking and compare their ideas with their partner’s ideas, a crucial component of developing reasoning skills (National Council of Teachers of Mathematics, 2000, p. 58). Well-designed cooperative learning opportunities result in more high-level reasoning and the development of new ideas, as well as more transfer of what is learned from one context to another context, which is crucial for the development of deep understanding (Johnson & Johnson, 1999, p. 72).

I have situated these lessons within a real-world context. Students are asked to measure and then convert units of length of actual objects in the classroom and their home. Students need to connect the skills they’re learning in math to the same skills they’ll need to solve problems in their daily life, because an integral part of developing conceptual understanding is teaching students why they need to know this information and how they will be able to apply it in their own lives (Burns, 2007, p. 233). Word problems and family activities in this unit are centered on West Seattle landmarks, and integrate my students’ interests in sports, technology, and music. By tapping students’ interests and background knowledge I can capitalize on their motivation, engagement and strengths in order to direct learning towards more abstract and critical thinking. When learning is focused on topics central to a student’s life they become more confident and engaged in their learning because you are accessing their “Funds of Knowledge” (Amanti, 2005, pp. 137-138).

I have modified the *Math in Focus* curriculum to include more problem-solving in order to develop students’ conceptual understanding and reasoning skills. As Paulo Freire advocated, “Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other” (Freire, 1970, p. 72). Students need to be put in these situations of facilitated struggle and as teachers we need to accept that student confusion is part of the process of them constructing new knowledge (Burns, 2007, p. 190). Successful teachers introduce students to complex material, while helping them decode it, discuss it, analyze it, repeat it, and explain it in order to solidify new knowledge (Delpit, 2012, p. 36), so my unit has been designed to follow this progression. I’ve built in inquiry-based learning opportunities, such as discovering the algorithms to convert smaller units to larger units based on their existing knowledge of converting larger units to smaller units and their understanding of the inverse relationship between multiplication and division. My instruction is designed to build on their previous learning and let students clarify and reorganize new information they receive (Burns, 2007, p. 267). I’ve equipped students with problem-solving strategies to scaffold this progression towards conceptual understanding by encouraging students to look for patterns, explain their reasoning, use manipulatives, and construct tables and graphic organizers to sort information (Burns, 2007, pp. 19-20). My goal is to help students develop deep understanding and proficiency with converting units of length by actively engaging in their learning.

**4.2 Oral and written language demands**

Decoding skills for new academic language, such as centimeter and kilometer, will be reinforced by continuing our study of Greek and Latin roots. I will also be teaching students new skill-based vocabulary such as analyze, justify, evaluate, brainstorm, and rationalize. Students will both use this vocabulary and practice the action in order to build their understanding of these new words. New academic language will be reinforced with visuals and anchor charts. These visual associations help students recall meaning of new words, particularly if the students help determine what visual is used for a new term (Zwiers, 2014, p. 209). It is also important that I model the use of this new academic language so that students become comfortable hearing these new mathematical terms in context (Zwiers, 2014, p. 102).

Discourse and the related language functions of explaining, paraphrasing and justifying will be central to this unit. Classroom-wide discussions as well as peer interactions require students to share what they know and why they know it, as well as try out new ideas and get feedback on those ideas (Burns, 2007, p. 36). Some of my students are more comfortable with abstract thought than others, so discourse allows for the dual benefit of some students learning from their peers while their peers get more practice expressing their thinking. Developmentally, fourth graders are increasingly more capable of abstract thought but enjoy having rules and logic to sort through that abstract thought (Wood, 2007, p. 125). This is a crucial time to get students to continue to reason about mathematics and verbally process their thinking as they explore more theoretical principles like conversion. By teaching my students to look for patterns they are able to rationalize these mathematical skills and further develop their conceptual understanding (NCTM, 2000, p. 56). I also plan to incorporate elements of written discourse into the lessons as students will be expected to write their rationales for certain concepts in their Math Notebooks. Reasoning must be developed in students consistently through many contexts (NCTM, 2000, p. 56) so offering students the opportunity to vocalize as well as scribe their thinking allows them valuable practice in expressing their reasoning.

**4.3 Special needs and abilities**

I do not have any students in my class who are English Language Learners or who are on IEPs. I do have several students who have either academic limitations or social-emotional issues that constrain their academic progress, so I have centered my special needs accommodations and modifications on these students. I have two students with ADHD. Neither of these students have IEPs because their ADHD has not yet impacted their academic performance to a level where an IEP is necessary. These students sit near the front of the classroom and have the option of sitting on a bouncy ball and using a screen divider during independent assignments. These offerings are environmental accommodations which allow for movement and activity as well as a space free from distractions (Friend & Bursack, 2015, p. 246). I will also provide these students with clear communication of the learning targets and expectations for behavior. Highlighting these key points before the lesson begins will help these two students focus on what is most important for their learning (Friend & Bursack, 2015, p. 248). To assist these students academically I will keep oral instruction time brief and offer frequent breaks for collaborative learning. These peer interactions are more engaging for students with ADHD and provide the additional benefit of a positive peer role models (Friend & Bursack, 2015, p. 246). I will also give these students additional time to complete independent assignments as their working time can be compromised by issues with focus (Friend & Bursack, 2015, pp. 246-247). These two students also often blurt out responses as they process information orally so I will use hand signals and other non-verbal clues to redirect them, and I will also acknowledge their appropriate and on-task behaviors so as to reinforce positive interactions (Friend & Bursack, 2015, p. 247).

I also have four students who I would classify as gifted, although my school has chosen to not test students for any gifted programs. I have characterized them as gifted based upon their eagerness to learn, their academic performance far surpassing their peers, and their ability to learn without much effort (Friend & Bursack, 2015, p. 29). I will provide enrichment activities for these students, such as an assignment to try and find the conversion rates between feet and meters based on comparisons between yard sticks and meter sticks. These enrichment activities provide my gifted students with the opportunity to use higher-order thinking skills to elaborate on concepts being taught in the mainstream curriculum (Friend & Bursack, 2015, p. 255). I will also use technology extensions to accelerate their learning and deepen the application of concepts learned in class (Friend & Bursack, 2015, p. 255). Students may either use this technology independently at home or during class-time when they have already learned the standard curriculum content for the day. These modifications help both alter the depth and complexity of my gifted students’ learning as well as increase the pace of instruction (Kettler & Curliss, 2003).

**6. EFFECTIVE TEACHERS USE FEEDBACK TO GUIDE THEIR OWN LEARNING**

I’ve given a lot of thought over the last two terms to how to challenge students while still allowing them to enjoy success. I have several students in my math group who are extremely anxious about math and not confident in their abilities, and several other students who are very confident in their math abilities but also have such a fear of failure that they don’t want to explore and take chances in their learning. Rosenshine (2012) advocates introducing new material followed by significant opportunities for guided practice so that students can develop skills in a supported environment (p. 17), which will help my students with anxiety. My students’ fears of failure shows a fixed mindset, which I hope to overcome by sharing my excitement and curiosity for new learning opportunities. Praising students’ intelligence gives them a short burst of pride (Dweck, 2007, p. 36), particularly in a group that is already identified as the highest achieving math students. Instead I want to use what I’ve learned in Block I about process praise, to acknowledging my students’ effort which encourages them to take on challenging tasks and embrace opportunities to learn (Dweck, 2007, p. 37).

From my child development strand of TEED 5012, I learned a lot about the specific cognitive, social-emotional and physical needs of the nine and ten year olds I teach, so I have tailored my lessons and activities to these developmental demands. Fourth graders are increasingly able to think abstractly but enjoy having rules and logic involved in that abstract thought, as well as ways to organize the new information they obtain (Wood, 2007, p. 125), which is why I’ve built in use of manipulatives, hands-on activities and anchor charts to categorize information visually in discrete, logical categories. They also love to work in groups and thrive on both cooperative and competitive activities (Wood, 2007, p. 124), so I’ve added way more interactive learning experiences than I’ve observed my cooperating teacher use. I will continue to adapt my pedagogy as I learn from my students, my colleagues, and my own experiences.

References

Amanti, C. (2005). Beyond a beads and feathers approach. In N. Gonzalez, L. C. Moll & C. Amanti (Eds.). *Funds of knowledge: theorizing practice in households, communities and classrooms* (131-141). Mahwah, NJ: L. Erlbaum Associates.

This chapter encourages teachers to connect learning to students Funds of Knowledge by linking content to their lived experiences, and by conducting home visits and surveys to familiarize yourself with students’ backgrounds. I used this concept to design lesson plans that link with students’ prior knowledge in order to help them develop deeper understandings of the content and themes.

Burns, M. (2007). *About teaching mathematics: A K-8 resource* (3rd ed.). Sausalito, CA: Math Solutions Publications.

This book was used to inform my lesson designs and progression, particularly my integration of conceptual understanding and procedural fluency in order to build problem-solving skills and proficiency converting units of measuring length.

Cavendish, M. (2015). *Math in focus: Singapore math.* Boston, MA: Houghton Mifflin Harcourt.

This is the math curriculum that is used by Seattle Public Schools. I used this resource to inform the progression and pacing of my unit plan.

Chapin, S. H., & Johnson, A. (2006). *Math matters: Understanding the math you teach, grade K-6* (2nd ed.). Sausalito, CA: Math Solutions Publications.

Research and recommendations in this book were used to frame my rationale for the progressive development of conceptual understanding and procedural fluency.

Delpit, L. (2012). *Multiplication is for white people: Raising expectations for other people’s children.* New York, NY: The New Press.

This book advocates for a culturally responsive teaching model that maintains high standards and a demanding curriculum in our poor schools, just as we do in our affluent schools. I used Delpit’s work to inform the culturally responsive teaching practices in my unit, and to form the basis of a demanding curriculum that requires critical thinking and problem solving.

Dweck, C. S. (2007).The perils and promises of praise. *Educational Leadership, 10*(1), 34-39.

This article warns of the issues with praising students about their intelligence, as it puts them in a fixed mindset and prevents them from persevering through challenge. I used this to inform my practice with particular students in my class who avoid situations where they could fail.

Freire, P. (1970). *Pedagogy of the oppressed.* (M. B. Ramos, Trans.). New York: Bloomsbury.

Paulo Freire was a leader in educational rights for the poor and for minorities. His book speaks to the need to develop education systems that offer opportunities for advancement and possibility for all students. I used Freire’s ideas and musings to inform my use of inquiry-based learning.

Friend, M., & Bursuck, W. D. (2015). Including students with special needs: A practical guide for classroom teachers. (8th ed.). Boston, MA: Pearson.

This book outlines theory and strategies centered on teaching students with special needs. The practices can also be applied to differentiating learning for all students. I used this book to develop learning opportunities and assessments that meet the needs of all of my students, particularly those with special needs.

Johnson, D. W., & Johnson, R. T. (1999). Making cooperative learning work. *Theory into Practice, 38*(2), 67-73.

This article is one of the leading resources on how to develop cooperative learning experiences that support all students and ensure that the outcomes of the group are greater than the sum of its parts. I used this resource to develop cooperative learning opportunities that are used frequently throughout my unit plan.

Kettler, T, & Curliss, M. (2003). Mathematical acceleration in a mixed-ability classroom: Applying a tiered objectives model. *Gifted Child Today, 26*(1).

I used this article to build instructional practices that meet the needs of my gifted students, including accelerating the pace of learning and providing opportunities for deepening context and conceptual understanding.

National Council of Teaching of Mathematics (2000). *Principles and Standards for School Mathematics.* Reston, VA: NCTM.

This article provides insight on how to develop students’ reasoning skills by integrating more discourse and proofs into math instruction.

Roberts, S. (2010). The conceptual chicken and the procedural egg. *Mathematics Teaching in the Middle School, 16*(4), 196-198.

This article was used to direct my lesson progression, creating an Ebb and Flow between procedural fluency and conceptual understanding.

Rosenshine, B. (2012). Principles of instruction: Research-based strategies that all teachers should know. *American Educator (2),* 12-39.

This article outlines ten foundational principles of good teaching, including checks for understanding, weekly review, scaffolding and modeling

Schwartz, D. (2006). *Millions to Measure.* New York, NY: Harper Collins.

This picture book will be used as a read-aloud to explore the history of the customary and the metric systems.

Silverstein, S. (1974). One inch tall. *Where the Sidewalk Ends.* New York, NY: Harper Collins.

This poem is written from the perspective of someone who is one inch tall and views all things in his world as relatively huge. It will be used to introduce units of measurement and relative size.

Wood, C. (2007). *Yardsticks: Children in the classroom ages 4-14* (3rd Ed.)*.* Turner Falls, MA: Northeast Foundation for Children.

This book, written for both teachers and parents, describes children’s cognitive, social-emotional, physical and academic growth with age-by-age narratives. This age-specific developmental understanding is then used by teachers to help inform their instructional and classroom management techniques. I used the sections on nine and ten year olds to shape my unit plan activities and format in order to align with my students’ developmental needs.

Zwiers, J. (2014). *Building academic language: Meeting Common Core Standards across disciplines, Grades 5-12* (2nd ed.). San Francisco, CA: Josey Bass.

This book provides a comprehensive guide to developing students’ ability to effectively use academic language in oral and written discourse. Zwiers provides countless strategies that teachers can use to help students develop proficiency and confidence with English language principles and skills. I used this resource to inform the language demands that this unit places on my students and to help me build suitable language supports to meet these demands.